

That which is claimed is:

1. A method for making a thin film partially transparent photovoltaic module comprising series connected cells, at least one amorphous semiconductor layer, a metal contact layer, and interconnects connecting the series connected cells,
5 the method comprising laser scribing a plurality of laser scribes at least through the metal contact and positioning the scribes in a direction that crosses the direction of the interconnects.

2. The method of Claim 1 further comprising bus bars located adjacent the first and last cell in the module and wherein the scribes extend across the surface of
10 the photovoltaic module but not including the bus bars.

3. The method of Claim 1 wherein the laser scribes are formed by using a laser to ablate semiconductor material which bursts through the metal contact layer to form the scribes.

4. The method of Claim 1 wherein the laser used to ablate the
15 semiconductor material is selected from the group consisting of Nd-YAG, Nd:YFL and Nd:YVO₄ lasers.

5. The method of Claim 1 wherein each scribe has a width of about 0.01 to about 0.5 mm and the scribes are spaced from each other about 0.5 to about 5 mm.

6. The method of Claim 5 wherein each scribe has a width of about 0.05
20 to about 0.2 mm.

7. The method of Claim 6 wherein the scribes are spaced from each other about 0.5 to about 2 mm.

8. The method of Claim 6 wherein no more than about 50 percent of the area of the metal contact layer comprises the laser scribes.

9. The method of Claim 6 wherein no more than about 20 percent of the
25 area of the metal contact layer comprises the laser scribes.

10. The method of Claim 1 wherein the laser scribes are positioned in a direction that is perpendicular to the direction of the interconnects.

11. The method of Claim 1 wherein the scribes are in the form of a series of
30 interconnected holes.

12. The method of Claim 11 wherein the holes are round and have a diameter of about 0.1 to about 0.2 mm.

13. The method of Claim 1 wherein the scribes are parallel to each other.

14. The method of Claim 1 wherein the scribes are grouped in bands of closely spaced scribes separated by bonds having few or no scribes.

15. The method of Claim 14 wherein each scribe has a width of about 0.05 to about 0.2 mm and are spaced from each other about 0.5 to about 2 mm.

5 16. The method of Claim 1 wherein the laser scribes are spaced from each other and the spacing is graded in at least a portion of the module.

17. A method of making a partially transparent photovoltaic module comprising series connected cells, at least one amorphous semiconductor layer, a metal contact layer, and interconnects connecting the series-connected cells, the
10 method comprising at least one selected from the group consisting of (a) laser scribing a plurality of scribes at least through the metal contact in a direction that crosses the direction of the interconnects and (b) selectively removing at least portions of the metal contact in a preselected pattern to impart a design, lettering, logo or other descriptive pattern on the photovoltaic module.

15 18. The method of Claim 17 wherein the method comprises selectively removing at least portions of the metal contact in a preselected pattern to impart a design, lettering, logo or other descriptive pattern on the photovoltaic module.

19. The method of Claim 18 wherein the metal contact is removed by laser scribing a pattern of holes.

20 20. The method of Claim 19 wherein the holes are connected.

21. The method of Claim 20 wherein the holes are round and have a diameter of about 0.1 to about 0.2 mm.

22. A method of making a photovoltaic module comprising series connected cells, at least one amorphous semiconductor layer, a metal contact layer,
25 and interconnects connecting the series connected cells comprising selectively removing portions of the metal contact using a laser for the purpose of permitting light to pass through the module where the metal is selectively removed.

23. The method of Claim 22 wherein the portions of metal removed are in the form of a plurality of holes.

30 24. The method of Claim 23 wherein at least some of the holes are connected.

25. The method of Claim 26 wherein the holes are round in shape.

26. The method of Claim 22 wherein the metal is removed by using the laser to ablate semiconductor material which bursts through the metal contact layer to remove the metal.

27. The method of Claim 22 wherein the module has a transmission of at least about 5 percent.

28. A thin film partially transparent photovoltaic module comprising series connected cells, at least one amorphous semiconductor layer, a metal contact layer, and interconnects connecting the series-connected cells, the module comprising a plurality of scribes at least through the metal contact layer positioned in a direction that crosses the direction of the interconnects.

29. The module of Claim 28 wherein each scribe has a width of about 0.01 to about 0.5 mm.

30. The module of Claim 29 wherein each scribe has a width of about 0.05 to about 0.2 mm.

31. The module of Claim 30 wherein the scribes are spaced from each other about 0.5 to about 5 mm.

32. The module of Claim 28 having a transmission of at least about 10 percent.

33. The module of Claim 28 having a transmission of least about 20 percent.

34. The module of Claim 28 wherein the scribes are in the form of connected holes.

35. The module of Claim 34 wherein the holes are round and have a diameter of about 0.01 to about 0.2 mm.

36. The module of Claim 28 further comprising bus bars located adjacent to the first and last cell in the module and wherein the laser scribes extend across the surface of the photovoltaic module but not including the bus bars.

37. A photovoltaic module comprising series connected cells, at least one amorphous semiconductor layer, a metal contact layer, and interconnects connecting the series-connected cells, the module comprising lettering, a logo or other descriptive pattern formed in and extending through the metal contact layer.

38. The photovoltaic module of Claim 37 wherein the descriptive pattern is formed by laser scribing a pattern of holes.

39. The photovoltaic module of Claim 38 wherein at least a portion of the holes are connected.

40. The photovoltaic module of Claim 38 wherein the holes are round and have a diameter of about 0.01 to about 0.2 mm.

5 41. A window comprising the photovoltaic module of Claim 28.

42. Sun screens and canopies comprising the photovoltaic modules of Claim 28.

43. The photovoltaic module of Claim 28 wherein the scribes are grouped in bands of closely spaced scribe lines separated by bands having few or no scribes.

10 44. The photovoltaic module of Claim 28 wherein the distance between at least a portion of the scribes is graded.

45. A method of manufacturing a photovoltaic device on a substrate, comprising the steps of:

15 (a) depositing a transparent conductive oxide film on a substrate to form a front contact layer;

(b) laser scribing substantially parallel first grooves in the front contact layer with a laser beam to form front electrode segments on the substrate;

20 (c) depositing and forming a layer or layers of a semiconductor material on said front electrode segments, and filling the first grooves with the semiconductor material;

(d) laser scribing second grooves in the layer or layers of semiconductor material at positions substantially parallel to the first grooves;

25 (e) depositing and forming a back contact layer comprising a metal on the layer or layers of semiconductor material, and filling the second grooves with the metal to form a series connection to connect the front electrode segments and the back contact layer;

(f) laser scribing third grooves in the back contact layer at positions substantially parallel to the second grooves with a laser beam; and

30 (g) laser scribing grooves in the back contact layer at a direction which crosses the direction of the second groove.

46. A method of manufacturing a photovoltaic device on a substrate, comprising the steps of:

- (a) depositing a transparent conductive oxide film on a substrate to form a front contact layer;
- (b) laser scribing substantially parallel first grooves in the front contact layer with a laser beam to form front electrode segments on the substrate;
- 5 (c) depositing and forming a layer or layers of a semiconductor material on the front electrode segments, and filling the first grooves with the semiconductor material;
- (d) laser scribing second grooves in the layer or layers of semiconductor material at positions substantially parallel to the first grooves;
- 10 (e) depositing and forming a back contact layer comprising a metal on the layer of semiconductor material, and filling the second grooves with the metal to form a series connection to connect the front electrode segments and the back contact layer;
- (f) laser scribing third grooves in the back contact layer at positions
15 substantially parallel to the second grooves with a laser beam; and
- (g) selectively removing sections of the back contact using a laser to impart a desired design, lettering, logo or other feature to the photovoltaic device.

47. The method of Claim 1 further comprising annealing the module after
20 laser scribing the plurality of laser scribes.

48. The method of Claim 1 further comprising ultrasonically cleaning the module after laser scribing the plurality of laser scribes.